AWARD NUMBER: W81XWH-16-1-0333

TITLE: Colorectal cancer immunotherapy by pharmacological suppression of Liver X Receptor activity

PRINCIPAL INVESTIGATOR: Katherine J. Carpenter

RECIPIENT: St. Louis University
St. Louis, MO 63103

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TYPE OF REPORT: Final

PREPARED FOR: U.S. Army Medical Research and Materiel Command
Fort Detrick, Maryland 21702-5012

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6. AUTHOR(S)

Katherine Carpenter

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5e. TASK NUMBER

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Saint Louis University
Saint Louis, MO 63103

8. PERFORMING ORGANIZATION REPORT NUMBER

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U.S. Army Medical Research and Materiel Command
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14. ABSTRACT

Colorectal cancer is a leading cancer diagnosis for men and women as there are 1 million new diagnosed patients every year. Cancer cells are known to secrete lipid metabolites that prevent the immune system from mounting a full antitumor response. These lipids activate the liver X receptor (LXRs) nuclear receptors that regulate lipid and carbohydrate metabolism, and immune function. One of the key cell types involved in initiating an anti-tumor response is the dendritic cell. A healthy dendritic cell probes the intracellular spaces, blood stream and lymphatic system for molecular fragments or antigens that indicate that diseased tissues, infection or tumor growth is present. If tumor growth is detected, dendritic cells will migrate to lymph nodes and present tumor associated antigens and secrete cytokines that are used to stimulate the activity of T-cells. These activated T-cells then migrate to the site of the tumor and commence destruction of any tumor cell baring the relevant tumor associated antigens. Tumor cells secrete ligands; lipid metabolites that activate the Liver-X-Receptor in dendritic cells and prevent dendritic cell migration to lymph nodes. In addition, lipid accumulation in the tumor microenvironment inhibit macrophage and T-cell activity. This is called tumor "masking" or immune evasion. In this study we proposed that, a

15. SUBJECT TERMS
Liver-X-Receptor, SR9243, Cancer, Immunotherapy

16. SECURITY CLASSIFICATION OF:	17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
			USAMRMC

a. REPORT	b. ABSTRACT	c. THIS PAGE			19b. TELEPHONE NUMBER *(include area code)*
Unclassified	Unclassified	Unclassified	Unclassified	23	

TABLE OF CONTENTS

1. INTRODUCTION:

It has been shown previously that colorectal tumors produce lipid metabolites; ligands for the liver-x-receptor (LXR) that inhibit immune mediated destruction of tumors. This proposal sought to demonstrate that perturbation of LXR activation in immune cells would promote immune mediated clearance of tumor cells. Specific Aim 1 to a reductionist approach in order to elucidate characteristic effects of disrupting LXR activation in dendritic, macrophages and T-cells specifically.

2. KEYWORDS:

Liver-X-Receptor, SR9243, Cancer, Immunotherapy

3. ACCOMPLISHMENTS:

The PI is reminded that the recipient organization is required to obtain prior written approval from the awarding agency grants official whenever there are significant changes in the project or its direction.

What were the major goals of the project?

List the major goals of the project as stated in the approved SOW. If the application listed milestones/target dates for important activities or phases of the project, identify these dates and show actual completion dates or the percentage of completion.

Specific Aim 1: Investigate whether LXR inverse agonists can specifically stimulate dendritic and T-cell activity in response to CRC cell-mediated immune silencing.	**Target Date**	**Completion Date**	**Projected Completion Date**
Major Task 1: Optimization of dendritic cell culture	**12/2017**	**03/2018**	**11/2017**
Isolation of bone marrow from Balb/c mice (1 mouse)	01/2017	01/2018	10/2017
Culture dendritic cells	01/2017	N/A	10/2017
Isolation of dendritic cells from Balb/c mice (1 mouse)	01/2017	03/2018	10/2017
FACs analysis of DC markers	02/2017	03/2018	11/2017
HRPO/ACURO Approval	11/2017	04/2017	04/2017
Milestones Achieved: Dendritic cell culture optimization/marker analysis. HRPO/ACURO Approval	12/2016	12/2017	10/2017
Major Task 2: Chemotaxis Assay	**03/2017**	**N/A**	**11/2017**
Isolation of bone marrow from Balb/c mice and DC culture (2 mice total)	4/2017	**02/2018**	**11/2017**
Generation of CT26.WT conditioned media	4/2017	**11/2017**	**11/2017**
Run chemotaxis assay and quantify numbers	4/2017	**11/2017**	**11/2017**
Milestone Achieved: Chemotaxis assay completed	4/2017	**11/2017**	**11/2017**
Major Task 3: T cell activation assay	**04/2017**	**N/A**	**12/2017**
Isolation of bone marrow from Balb/c mice (2 mice total), DC culture, CT26.WT culture, and T cell culture	03/2017	11/2017	11/2017
Co-culture CT26.WT and dendritic cells and purify DCs	04/2017	11/2017	11/2017

Co-culture activated DCs and naïve T cells and perform FACs analysis	04/2017	N/A	11/2017
Milestone Achieved: T cell activation assay completed.	04/2017	N/A	07/2018
Specific Aim 2: Test the efficacy of LXR inverse agonists in treating colorectal cancer in vivo.			
Major Task 4: Colorectal cancer xenograft model	**07/2017**	**07/2017**	**08/2017**
Purchase cohort of Balb/c mice (12 mice total): 4-6 weeks old	06/2017	06/2017	**08/2017**
Culture and inject CT26.WT cells	05/2017	05/2017	**08/2017**
Allow tumors to establish	06/2017	06/2017	**08/2017**
Treat with SR9243 for 20 days and measure tumor volume	07/2017	07/2017	**08/2017**
Sacrifice mice and perform FACs analysis on immune cells	07/2017	07/2017	**08/2017**
Immunohistochemistry on tumor sections	07/2017	07/2017	**08/2017**
Quantitative polymerase chain reaction on tumors (look at LXR-related target genes)	07/2017	07/2017	**08/2017**
Milestones Achieved: 1. Xenograft study completed 2. FACs analysis of immune cells completed 3. Immunohistochemistry on tumor sections completed 4. QPCR on tumors completed.	05/2017	07/2017	**11/2017**
Major Task 5: APC colorectal cancer genetic model	**09/2017**	**09/2017**	**09/2017**
Purchase *APC*$^{15lox/+}$ mice: 4-6 weeks old (40 mice total)	07/2017	07/2017	07/2017
Treat with SR9243 for 20 days	08/2017	08/2017	07/2017
Sacrifice mice and perform FACs analysis on immune cells	09/2017	11/2017	07/2017
Immunohistochemistry on tumor sections	09/2017	01/2018	07/2017
Quantitative polymerase chain reaction on tumors (look at LXR-related target genes)	09/2017	01/2018	01/2018
Milestones Achieved: 1. APC CRC genetic model completed 2. FACs analysis of immune cells completed 3. Immunohistochemistry on tumors completed 4. QPCR on tumors completed	09/2017	01/2018	02/2018

What was accomplished under these goals?

For this reporting period describe: 1) major activities; 2) specific objectives; 3) significant results or key outcomes, including major findings, developments, or conclusions (both positive and negative); and/or 4) other achievements. Include a discussion of stated goals not met. Description shall include pertinent data and graphs in sufficient detail to explain any significant results achieved. A succinct description of the methodology used shall be provided. As the project progresses to completion, the emphasis in reporting in this section should shift from reporting activities to reporting accomplishments.

Major Activities:

a. **Investigate whether LXR inverse agonists can specifically stimulate dendritic and T-cell activity in response to CRC cell-mediated immune silencing:** Of the two specific aims/major objectives this first objective has proven the most challenging. A number of technical issues have slowed the progress and prevented the completion of these some key specific objectives. Nonetheless we expect to complete our objectives overall before or on the projected deadline.

b. **Test the efficacy of LXR inverse agonists in treating colorectal cancer in vivo.** This aim has been carried out to 95% completion. Some post experimental analysis of histological data is still pending. However, the major objectives have been accomplished successfully.

Specific Objectives:

The following specific objectives have been accomplished;

c. **Major Task 1: Optimization of dendritic cell culture:** While we have made promising progress, we have not been able to consistently generate dendritic cell cultures in vitro. A number of factors may have contributed to this including infections in our mouse colony that significantly reduced the number of mice available for experimental use. In addition, reagent reliability has proven elusive. We are however making strides toward correcting these technical issues and should be able to complete this task by the projected completion date.

d. **Major Task 2: Chemotaxis Assay:** A number of chemotaxis assays have already been successfully run for cultured macrophages but not dendritic cells for the reasons described above in Task 1.

e. **Major Task 3: T cell activation assay:** As we have been unable to generate large enough populations of dendritic cells for T-cell activation assays these experiments have not been conducted. The timeline for completion of these studies should occur as predicted once the goals of Task1 are complete.

f. **Major Task 4: Colorectal cancer xenograft model:** Our goal of assessing the effects of SR9243 on 1.) Tumor growth, 2.) Immune cell activation 3.) Infiltration of tumor microenvironment by immune cells has been completed. All the goals and milestones for this activity have been successfully completed. The results are included in Figure 1

g. **Major Task 5: APC colorectal cancer genetic model:** We are the first to test an LXR inverse agonist in a genetic model of colorectal carcinogenesis. We were able to successfully assess the effect of LXR suppression in a genetic model of colorectal cancer APC^{min} mice. Our results showed that the drug had limited efficacy as it was not able to inhibit total colon polyp formation. Although quantitative assessment of the responsiveness of this model suggest that our experimental design may need adjustment. Of the state goals only the histological assessments needed to conclude these experiments are still needed. We plan to repeat these experiments however, in a more relevant orthotopic model of colon cancer.

Significant results or key outcomes:

We were able to demonstrate that SR9243 an LXR inverse agonist potently inhibits CT26WT tumor xenograft growth without directly affecting tumor cell metabolism. Our results also suggest that LXRs modulate macrophage lipid metabolism in response to tumor growth. We also show the LXR inverse agonist can be used to target tumor induced augmentation of macrophage lipid uptake. These results suggest that SR9243 was stimulating immune mediated destruction of the tumors which was the central aim of this study.

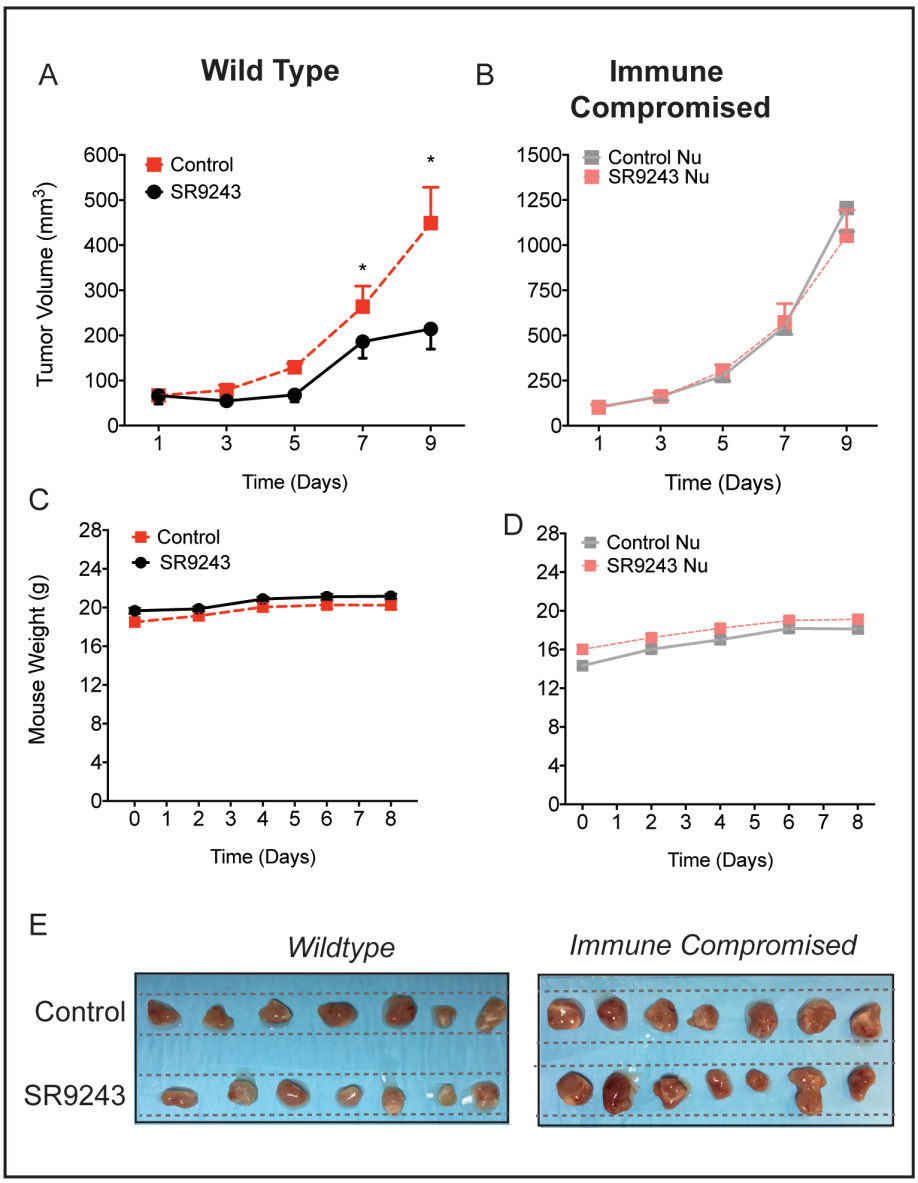

Figure 1: The effects of SR9243 in a colorectal cancer xenograft model (Results of Major Task 4). **A** Tumor growth reduction in response to SR9243 drug treatment of wild type immune-competent and **B** immune compromised CT26WT tumor-bearing mice. **C-D.** Total body weight of mice **A** and **B** respectively. **E.** Image of CT26WT tumors in wildtype and immune-compromised mice treated with SR9243 or vehicle control.

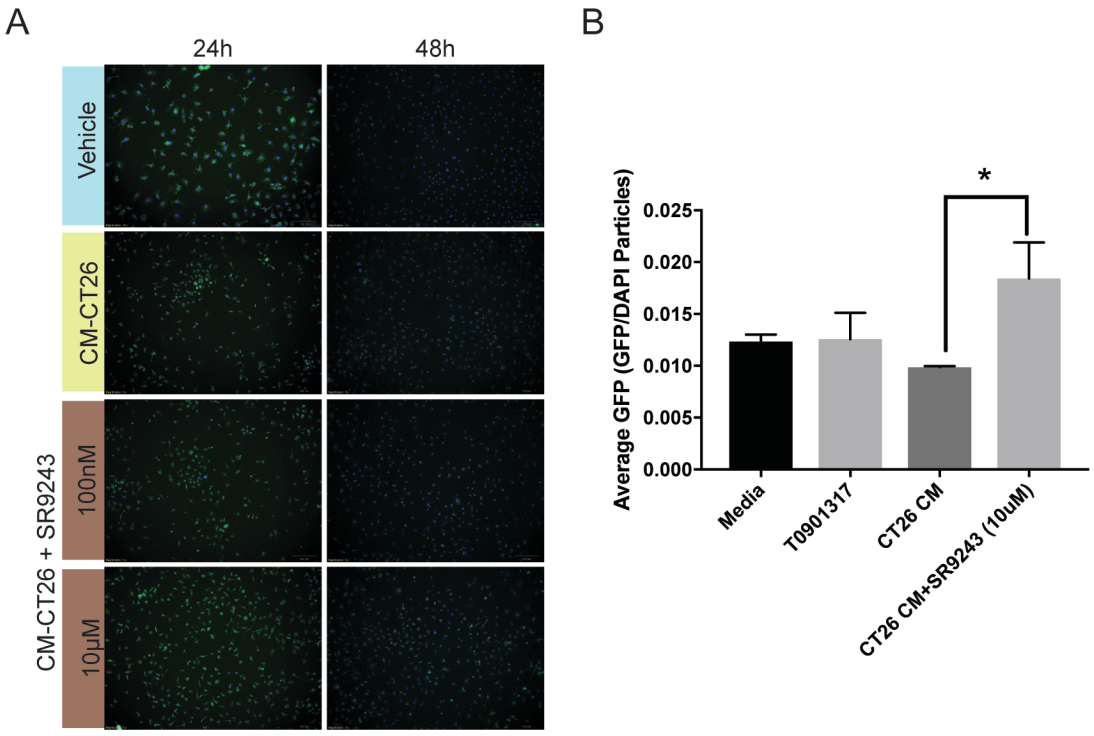

Figure 2: The SR9243 modulates macrophage lipid storage in response to tumor growth. **A** CT26WT Tumor condition media (CM-CT26) reduces macrophage lipid content this effect is reversed by SR9243. **B** Quantification of BODIPY fluorescence in macrophages exposed to CT26WT conditioned media with or without treatment with SR9243.

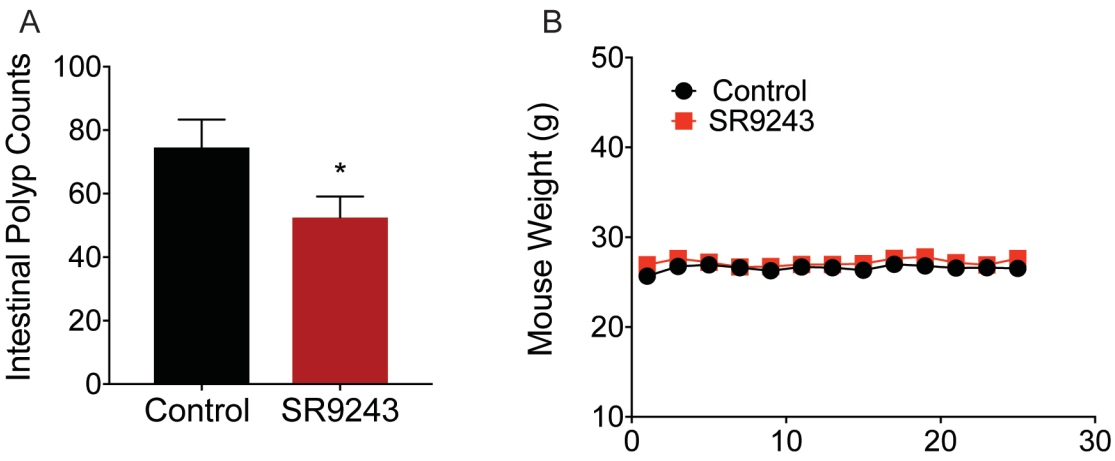

Figure 3: LXR inhibition blocks polyp formation in the mouse model of Familial Adenomatous Polyposis APC^{min} mice. **A** Polyp counts in APC mice treated with SR9243 or vehicle control. **B** Total body weight of mice treated with SR9243 or vehicle.

What opportunities for training and professional development has the project provided?
If the project was not intended to provide training and professional development opportunities or there is nothing significant to report during this reporting period, state "Nothing to Report."

Describe opportunities for training and professional development provided to anyone who worked on the project or anyone who was involved in the activities supported by the project. "Training" activities are those in which individuals with advanced professional skills and experience assist others in attaining greater proficiency. Training activities may include, for example, courses or one-on-one work with a mentor. "Professional development" activities result in increased knowledge or skill in one's area of expertise and may include workshops, conferences, seminars, study groups, and individual study. Include participation in conferences, workshops, and seminars not listed under major activities.

The PI Katherine Carpenter presented at the following conferences:
Posters:
1. Integrating Metabolism and Immunity. Keystone Symposia; 2017 May/Jun 29-2; Dublin in Ireland.
2. Cell Symposia: Translational Immunometabolism 2018 June 24-26th; Basel Switzerland
3. St. Louis University Graduate Student Association Symposium

How were the results disseminated to communities of interest?
If there is nothing significant to report during this reporting period, state "Nothing to Report."

Describe how the results were disseminated to communities of interest. Include any outreach activities that were undertaken to reach members of communities who are not usually aware of these project activities, for the purpose of enhancing public understanding and increasing interest in learning and careers in science, technology, and the humanities.

Nothing to Report

What do you plan to do during the next reporting period to accomplish the goals?
If this is the final report, state "Nothing to Report."

Describe briefly what you plan to do during the next reporting period to accomplish the goals and objectives.

Nothing to Report

4. **IMPACT:** Describe distinctive contributions, major accomplishments, innovations, successes, or any change in practice or behavior that has come about as a result of the project relative to:

What was the impact on the development of the principal discipline(s) of the project?
If there is nothing significant to report during this reporting period, state "Nothing to Report."

Describe how findings, results, techniques that were developed or extended, or other products from the project made an impact or are likely to make an impact on the base of knowledge, theory, and research in the principal disciplinary field(s) of the project. Summarize using language that an intelligent lay audience can understand (Scientific American style).

Nothing to Report

What was the impact on other disciplines?
If there is nothing significant to report during this reporting period, state "Nothing to Report."

Describe how the findings, results, or techniques that were developed or improved, or other products from the project made an impact or are likely to make an impact on other disciplines.

Nothing to Report

What was the impact on technology transfer?
If there is nothing significant to report during this reporting period, state "Nothing to Report."

Describe ways in which the project made an impact, or is likely to make an impact, on commercial technology or public use, including:

- *transfer of results to entities in government or industry;*
- *instances where the research has led to the initiation of a start-up company; or*
- *adoption of new practices.*

Nothing to Report

What was the impact on society beyond science and technology?
If there is nothing significant to report during this reporting period, state "Nothing to Report."

Describe how results from the project made an impact, or are likely to make an impact, beyond the bounds of science, engineering, and the academic world on areas such as:

- *improving public knowledge, attitudes, skills, and abilities;*
- *changing behavior, practices, decision making, policies (including regulatory policies), or social actions; or*
- *improving social, economic, civic, or environmental conditions.*

Nothing to Report

5. CHANGES/PROBLEMS: The PD/PI is reminded that the recipient organization is required to obtain prior written approval from the awarding agency grants official whenever there are significant changes in the project or its direction. If not previously reported in writing, provide the following additional information or state, "Nothing to Report," if applicable:

Changes in approach and reasons for change
Describe any changes in approach during the reporting period and reasons for these changes. Remember that significant changes in objectives and scope require prior approval of the agency.

Nothing to Report

Actual or anticipated problems or delays and actions or plans to resolve them
Describe problems or delays encountered during the reporting period and actions or plans to resolve them.

Nothing to report

Significant changes in use or care of human subjects, vertebrate animals, biohazards, and/or select agents
Describe significant deviations, unexpected outcomes, or changes in approved protocols for the use or care of human subjects, vertebrate animals, biohazards, and/or select agents during the reporting period. If required, were these changes approved by the applicable institution committee (or equivalent) and reported to the agency? Also specify the applicable Institutional Review Board/Institutional Animal Care and Use Committee approval dates.

Significant changes in use or care of human subjects

Nothing to Report

Significant changes in use or care of vertebrate animals

Nothing to Report

Significant changes in use of biohazards and/or select agents

Nothing to Report

6. **PRODUCTS:** List any products resulting from the project during the reporting period. If there is nothing to report under a particular item, state "Nothing to Report."

- **Publications, conference papers, and presentations**
  Report only the major publication(s) resulting from the work under this award.

  Journal publications. *List peer-reviewed articles or papers appearing in scientific, technical, or professional journals. Identify for each publication: Author(s); title; journal; volume: year; page numbers; status of publication (published; accepted, awaiting publication; submitted, under review; other); acknowledgement of federal support (yes/no).*

  The following posters pertaining the work conducted on this projected were presented at the listed scientific conferences.

  - **International Conferences**:
    Name: Keystone Symposia-Integrating Metabolism and Immunity.
    Date: 2017, May 29th-Jun 2nd
    Location: Dublin, Ireland.
    Poster Title: Cancer immunotherapy via pharmacologic inhibition of the liver X receptors. **Authors:** Katherine J. Carpenter, Suomia Abuirqeba, Shabnam Majidi, Monideepa Sengupta, Arindam Chatterjee, Thomas P. Burris, and Colin A. Flaveny.

  - **Local/Regional Conferences:**
    Name: Spring 2016 Saint Louis University Pharmacology & Physiology Department Retreat; **Date:** 2016, May 17th
    Location: St. Louis, MO
    Poster Title: Breast cancer immunotherapy by pharmacological suppression of the liver-X-receptor.
    Authors: Katherine J. Carpenter, Shabnam Majidi, Arindam Chatterjee, Thomas P. Burris, and Colin A. Flaveny.

Books or other non-periodical, one-time publications. *Report any book, monograph, dissertation, abstract, or the like published as or in a separate publication, rather than a periodical or series. Include any significant publication in the proceedings of a one-time conference or in the report of a one-time study, commission, or the like. Identify for each one-time publication: author(s); title; editor; title of collection, if applicable; bibliographic information; year; type of publication (e.g., book, thesis or dissertation); status of publication (published; accepted, awaiting publication; submitted, under review; other); acknowledgement of federal support (yes/no).*

Nothing to Report

Other publications, conference papers and presentations. *Identify any other publications, conference papers and/or presentations not reported above. Specify the status of the publication as noted above. List presentations made during the last year (international, national, local societies, military meetings, etc.). Use an asterisk (*) if presentation produced a manuscript.*

Nothing to Report

- **Website(s) or other Internet site(s)**
  List the URL for any Internet site(s) that disseminates the results of the research activities. A short description of each site should be provided. It is not necessary to include the publications already specified above in this section.

Nothing to Report

- **Technologies or techniques**
  Identify technologies or techniques that resulted from the research activities. Describe the technologies or techniques were shared.

Nothing to Report

- **Inventions, patent applications, and/or licenses**
  Identify inventions, patent applications with date, and/or licenses that have resulted from the research. Submission of this information as part of an interim research performance progress report is not a substitute for any other invention reporting required under the terms and conditions of an award.

Nothing to Report

- **Other Products**
  Identify any other reportable outcomes that were developed under this project. Reportable outcomes are defined as a research result that is or relates to a product, scientific advance, or research tool that makes a meaningful contribution toward the understanding, prevention, diagnosis, prognosis, treatment and /or rehabilitation of a disease, injury or condition, or to improve the quality of life. Examples include:
  - *data or databases;*
  - *physical collections;*
  - *audio or video products;*
  - *software;*
  - *models;*
  - *educational aids or curricula;*
  - *instruments or equipment;*
  - *research material (e.g., Germplasm; cell lines, DNA probes, animal models);*
  - *clinical interventions;*
  - *new business creation; and*
  - *other.*

Nothing to Report

7. PARTICIPANTS & OTHER COLLABORATING ORGANIZATIONS

What individuals have worked on the project?

Provide the following information for: (1) PDs/PIs; and (2) each person who has worked at least one person month per year on the project during the reporting period, regardless of the source of compensation (a person month equals approximately 160 hours of effort). If information is unchanged from a previous submission, provide the name only and indicate "no change".

Example:

Name:	*Mary Smith*
Project Role:	*Graduate Student*
Researcher Identifier (e.g. ORCID ID):	*1234567*
Nearest person month worked:	*5*
Contribution to Project:	*Ms. Smith has performed work in the area of combined error-control and constrained coding.*
Funding Support:	*The Ford Foundation (Complete only if the funding support is provided from other than this award.)*

Name:	*Katherine J. Carpenter*
Project Role:	*Graduate Student (PI)*
Nearest person month worked:	*12*
Contribution to Project:	*Mrs. Carpenter has performed all the experiments outlined under this award*
Name:	*Dr. Colin A. Flaveny*
Project Role:	*Mentor*
Nearest person month worked:	*no measureable effort*
Contribution to Project:	*Dr. Flaveny has mentored Mrs. Carpenter throughout the execution of the tasks outlined in this award*
Name:	*Dr. Thomas P. Burris*
Project Role:	*Mentor*
Nearest person month worked:	*no measureable effort*
Contribution to Project:	*Dr. Burris has co-mentored Mrs. Carpenter throughout the execution of the tasks outlined in this award*

Has there been a change in the active other support of the PD/PI(s) or senior/key personnel since the last reporting period?
If there is nothing significant to report during this reporting period, state "Nothing to Report."

If the active support has changed for the PD/PI(s) or senior/key personnel, then describe what the change has been. Changes may occur, for example, if a previously active grant has closed and/or if a previously pending grant is now active. Annotate this information so it is clear what has changed from the previous submission. Submission of other support information is not necessary for pending changes or for changes in the level of effort for active support reported previously. The awarding agency may require prior written approval if a change in active other support significantly impacts the effort on the project that is the subject of the project report.

Nothing to Report

What other organizations were involved as partners?
If there is nothing significant to report during this reporting period, state "Nothing to Report."

Describe partner organizations – academic institutions, other nonprofits, industrial or commercial firms, state or local governments, schools or school systems, or other organizations (foreign or domestic) – that were involved with the project. Partner organizations may have provided financial or in-kind support, supplied facilities or equipment, collaborated in the research, exchanged personnel, or otherwise contributed.

Provide the following information for each partnership:
<u>Organization Name:</u>
<u>Location of Organization: (if foreign location list country)</u>
<u>Partner's contribution to the project</u> (identify one or more)

- *Financial support;*
- *In-kind support (e.g., partner makes software, computers, equipment, etc., available to project staff);*
- *Facilities (e.g., project staff use the partner's facilities for project activities);*
- *Collaboration (e.g., partner's staff work with project staff on the project);*
- *Personnel exchanges (e.g., project staff and/or partner's staff use each other's facilities, work at each other's site); and*
- *Other.*

Nothing to Report

8. APPENDICES: N/A

Katherine J. Carpenter

b

Research

- Saint Louis University, Dr. Colin Flaveny and Dr. Tom Burris's Lab (03/2015-Present)
- University of Alabama at Birmingham, Dr. Nicole Riddle's Lab (05/2013-04/2014)
- University of Alabama at Birmingham, Dr. Tino Unlap's Lab (08/2012-05/2013)
- Howard Hughes Medical Institute Science Education Alliance Phage Hunters Advancing Genomic and Evolutionary Science Program (08/2011-05/2012)
- HudsonAlpha Institute for Biotechnology, Dr. Rick Myers's Lab (06/2011-07/2011)

Education

Saint Louis University (08/2014-Present)

Pharmacology and Physiology Department Doctoral Candidate

University of Alabama at Birmingham (08/2010-04/2014)

Bachelor of Science in Molecular Biology with Chemistry Minor

- 4-year Golden Excellence Academic Scholarship
- Selected to Experiential Learning Scholars Program (ELSP): President of ELSP Executive Council 2013-2014, Junior Representative to ELSP Advisory Board 2012-2013, Sophomore Representative to ELSP Advisory Board 2011-2012, Co-Chair of ELSP Social Committee 2011-2012
- Dean's List 2010, 2011
- President and Founding Member of Genetics Club at UAB 2013-2014

Research Support

CA150899 (Role: PI)

09/2016-09/2017

Department of Defense Peer Reviewed Cancer Research Program Horizon Award

"Colorectal cancer immunotherapy by pharmacological suppression of liver X receptor activity"

Presentations

Talks

- Immunotherapeutic treatment of cancer via pharmacologic inhibition of liver X receptor, Oral presentation at: Fall 2015 Saint Louis University Pharmacology & Physiology Department Retreat; St. Louis, MO

Posters

- **Katherine J. Carpenter**, Suomia Abuirqeba, Shabnam Majidi, Monideepa Sengupta, Arindam Chatterjee, Thomas P. Burris, and Colin A. Flaveny. Cancer immunotherapy via pharmacologic inhibition of the liver X receptors. Presented at: Integrating Metabolism and Immunity. Keystone Symposia; 2017 May/Jun 29-2; Dublin, Ireland.
- **Katherine J. Carpenter**, Shabnam Majidi, Arindam Chatterjee, Thomas P. Burris, and Colin A. Flaveny. Breast cancer immunotherapy by pharmacological suppression of the liver-X-receptor, Presented at: Spring 2016 Saint Louis University Pharmacology & Physiology Department Retreat; 2016, May 17; St. Louis, MO
- **Katherine J. Carpenter**, Shabnam Majidi, Arindam Chatterjee, Thomas P. Burris, and Colin A. Flaveny. Breast cancer immunotherapy by pharmacological suppression of the liver-X-receptor. Presented at: Immunity and Immunosuppression Meet Targeted Therapies. Keystone Symposia Cancer Immunotherapy; 2016 Jan 24-28; Vancouver, B.C., Canada.
- **Katherine J. Carpenter**, Shabnam Majidi, Colin A. Flaveny, and Thomas P. Burris. Breast cancer immunotherapy by pharmacological suppression of liver X receptor, Presented at: American Physician Scientists Association Midwest Regional Meeting; 2015, Oct 23-24; St. Louis, MO.
- **Katherine J. Beaufait**, Olivia M. Delmas, and Nicole C. Riddle. Use of transcription activator-like effector endonucleases (TALENs) to introduce single amino acid changes in *Drosophila melanogaster* HP1a, HP1B, and HP1C, Poster presented at: Spring 2014 University of Alabama at Birmingham Expo; 2014 Apr 11; Birmingham, AL.
- **Katherine J. Beaufait** and Nicole C. Riddle. Use of transcription activator-like effector endonucleases (TALENs) to introduce single amino acid changes in *Drosophila melanogaster* HP1a, HP1B, and HP1C, Poster presented at: American Society for Cell Biology Annual Meeting; 2013 Dec 14-18; New Orleans, LA.
- **Katherine J. Beaufait** and Nicole C. Riddle. Use of transcription activator-like effector endonucleases (TALENs) to introduce single amino acid changes in *Drosophila melanogaster*

HP1a, HP1B, and HP1C, Poster presented at University of Alabama at Birmingham Summer 2013 Expo; 2013 Jul 25; Birmingham, AL.

- Laura Aristizabal, **Katherine Beaufait,** Erik McGuire, Carley McWilliams, Christine Nguyen Rikita Patel, Ramya Singireddy, Angelina Londono-Joshi, and Denise Monti. 2012. Isolation and Characterization of 5 Novel Mycobacteriophages. Poster presented at: University of Alabama at Birmingham Spring 2012 Expo; 2012 Apr 20; Birmingham, AL.
- **Katherine J. Beaufait**, Kelly T. Williams, Richard M. Myers. Compartive transcriptome profiling in zebrafish larvae treated with pyridostigmine bromide, galanthamine hydrobromide, and rivastigmine tartrate. Poster presented at: Summer 2011 BioTrain Poster Session; 2011 Jul 29; Huntsville, AL.

Publications

- Rev-Erb co-regulates muscle regeneration via tethered interaction with the NF-Y cistrome. Ryan D. Welch, Chun Guo, Monideepa Sengupta, **Katherine J. Carpenter**, Natalie A. Stephens, Stacy A. Arnett, Marvin J. Meyers, Lauren M. Sparks, Steven R. Smith, Jinsong Zhang, Thomas P. Burris, and Colin A. Flaveny. *Molecular Metabolism*, 19;6(7):703-714. Doi: 10/1016/j.molmet.2017.05.001.
- Complete Genome [Internet]. Bethesda (MD): National Library of Medicine (US), National Center for Biotechnology Information; [2013] – Accession No. KC661271, Mycobacterium phage Dhanush, complete genome. Available from: https://www.ncbi.nlm.nih.gov/nuccore/KC661271
- Fishing for Success. **Katherine J. Beaufait.** *Inquiro*, **5**, 19 (2011).

Professional Organizational Memberships

- American Association for Cancer Research (2017)
- Genetics Society of America (2014)
- American Society of Cell Biology (2013)

Mentorship

- Sheetal Sethupathi
- Arko Chatterjee
- Shabnam Majidi
- Olivia Delmas

Teaching

- Section Director and Lecturer, Fall 2017, Saint Louis University (Drugs We Use and Abuse)
- Guest Lecturer, Spring 2017, Saint Louis University (Foundations of Immunobiology)

- Teaching Assistant, Fall 2011, University of Alabama at Birmingham (Impacting the Community through Service Learning)

Volunteer

- KidsQuest Children's Museum (06/2014-07/2014)
    - Assisted with Art Explorers I, Science Explorers I, and Engineering Adventures: Creative Computing summer camps, led guided science activities on the museum floor, helped with exhibit upkeep and building new exhibit
- University of Alabama at Birmingham Girls in Science & Engineering Day (04/12/2017)
    - Assisted with Reptilian Biology workshop
- Better Basics HOPE Center (09/2010-12/2011)
    - Tutored kindergarten-4th grade students and created fitness activities